



Virtual Ethernet Bridging in Server end stations

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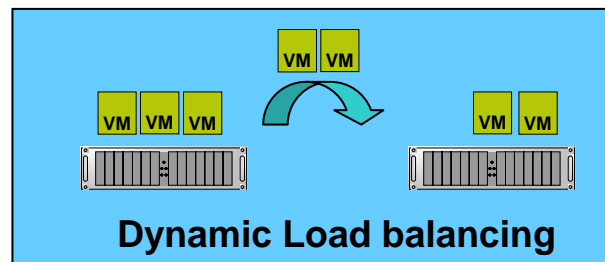
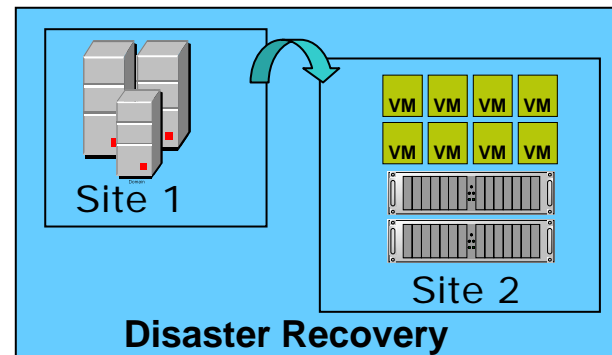
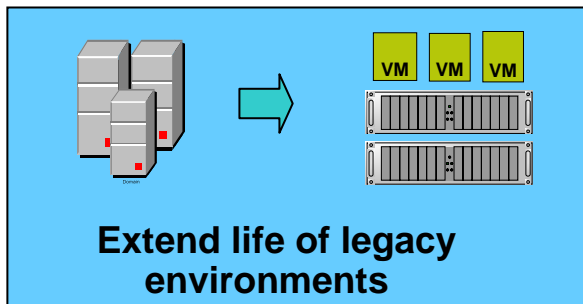
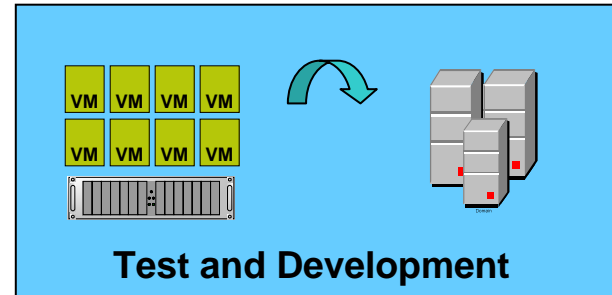
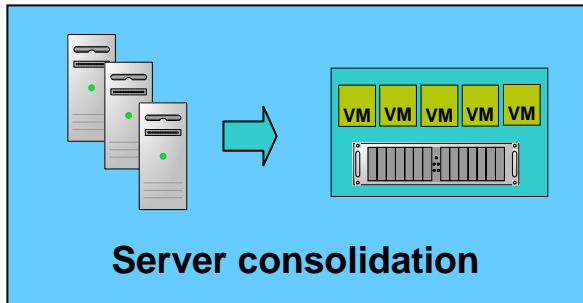
Sep 16, 2008

Outline

- Server Virtualization usage models
- Server I/O virtualization
- Virtual Ethernet Bridging evolution
 - Server based
 - Emulated Virtual Bridging in VMM/IOVM
 - Embedded Virtual Bridging in NIC
 - Network based
 - Virtual Bridging in Network Access Bridge
- Considerations for IEEE Standardization
- Summary

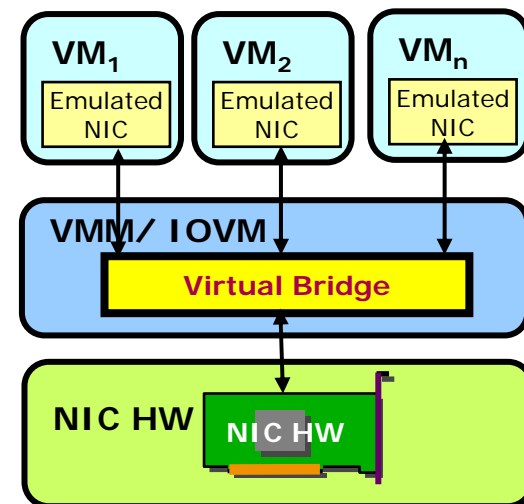


Server virtualization Usage Models



Server I/O Virtualization concepts

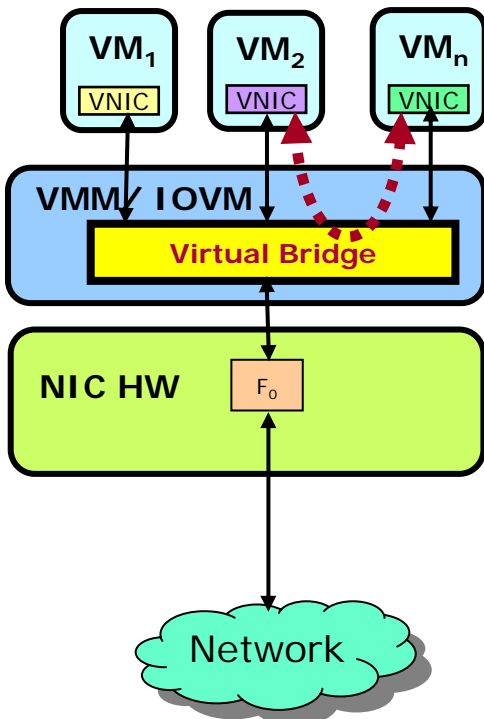
- Virtualization is the creation of a number of different execution environments on a single computer
 - The execution environments are called Virtual Machines (VM)
 - A VM has it's own operating system and resources
- A software layer that creates and maintains the Virtual Machine environment is called a Virtual Machine Monitor (VMM)
 - VMM provides capabilities such as NIC emulation, VM migration, and Virtual bridging functionality
- Virtual bridging allows software sharing of a hardware NIC between multiple VMs
- PCI-SIG SR-IOV provides a standard mechanism for hardware sharing of I/O devices



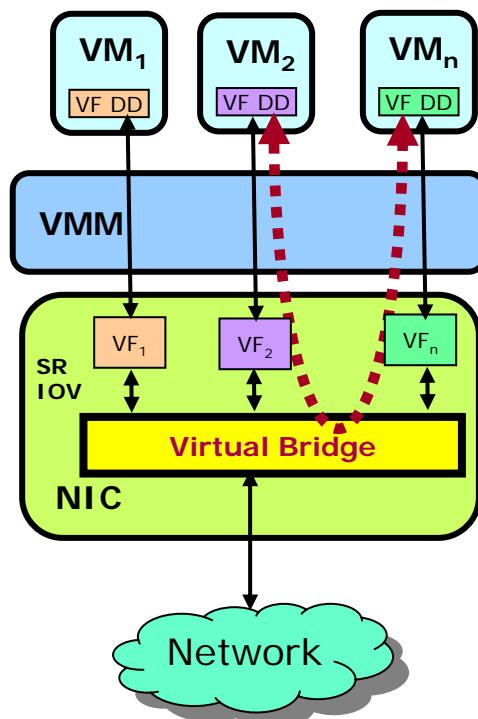
Virtual Bridge evolution

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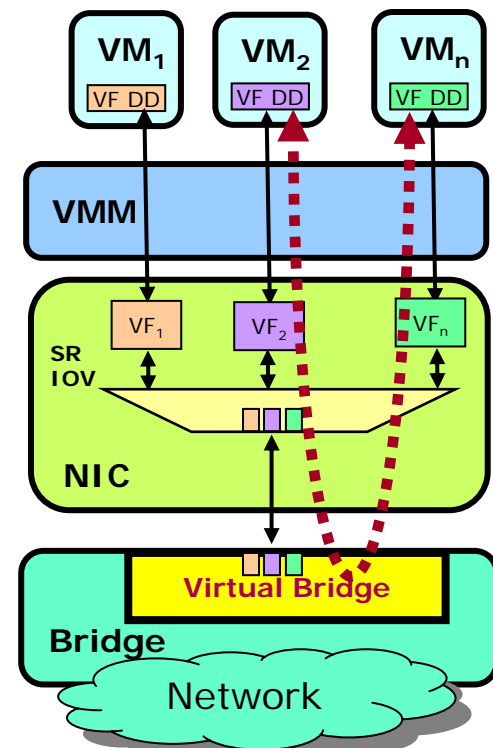
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Virtual Bridging in VMM or IOVM



Virtual Bridging in NIC

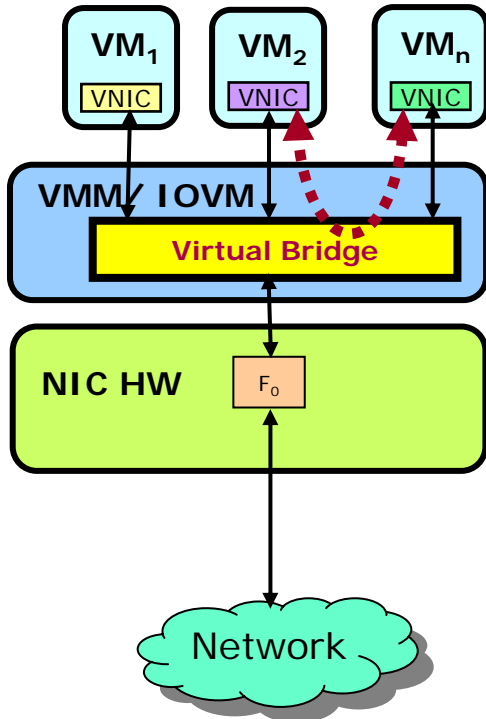


Virtual Bridging in Network Access Bridge

Three Virtual Bridging models expected to coexist



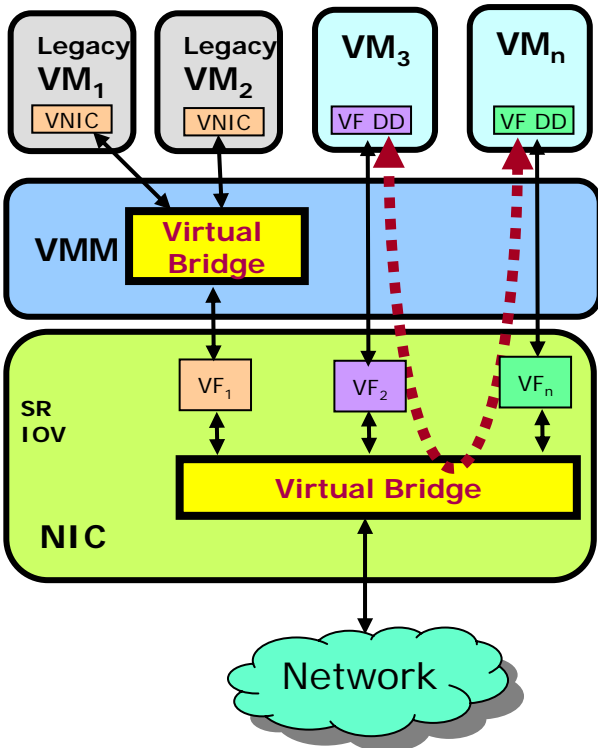
Virtual Bridge in VMM/IOVM



**Virtual Bridging
in VMM or IOVM**

- Virtual Bridging for SW sharing of HW NIC
 - Provides VM to VM communication and VM to Network communication
- Virtual bridges in VMM/IOVM
 - Abstraction of an Ethernet bridge
 - Implementations have varying levels of functionality
 - Most implementations do not support spanning tree hence loops not allowed
 - Unicast, Multicast and Broadcast forwarding
 - Most implementations support VLAN
 - Some level of QoS
 - Most support “Teaming” or Link aggregation
- VM migration
 - Virtual Bridge port properties migrate to different physical servers during VM migration
 - Bridge changes are transparent to VMs because of common bridge functionality and management
- Separate administrative domain
 - Virtual bridges configured and managed as part of Server management

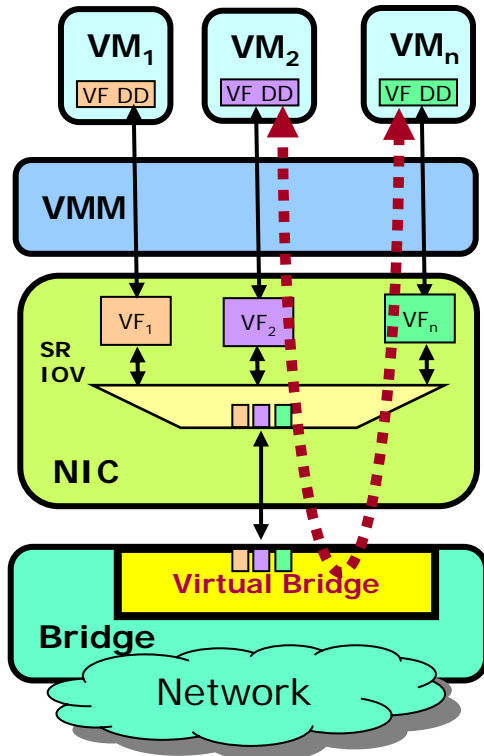
Embedded Virtual Bridge in NIC



Virtual Bridging in
NIC

- SR-IOV for hardware sharing of NIC
 - NIC partitioned to multiple Virtual Functions (VF)
 - VFs directly assigned to VMs
 - Eliminates software sharing layer in VMM/IOVM
- Virtual Bridging moves to NIC
 - Required for VM to VM communication and VM to external network communication
- NIC Virtual Bridge functionality
 - Varying level of functionality between NIC vendors
 - Varying level of functionality between SW Virtual Bridges and NIC Virtual Bridges
- Varying level of functionality creates problems
 - Interoperability, and Bridge Management
 - Loss of Bridge transparency for VM migration
- VM migration
 - Interoperability between NIC Bridge and Software Bridge required to ensure VM migration
- Separate administrative domain
 - Virtual Bridges configured and managed as part of Server management

Virtual bridging in Network Access Bridge

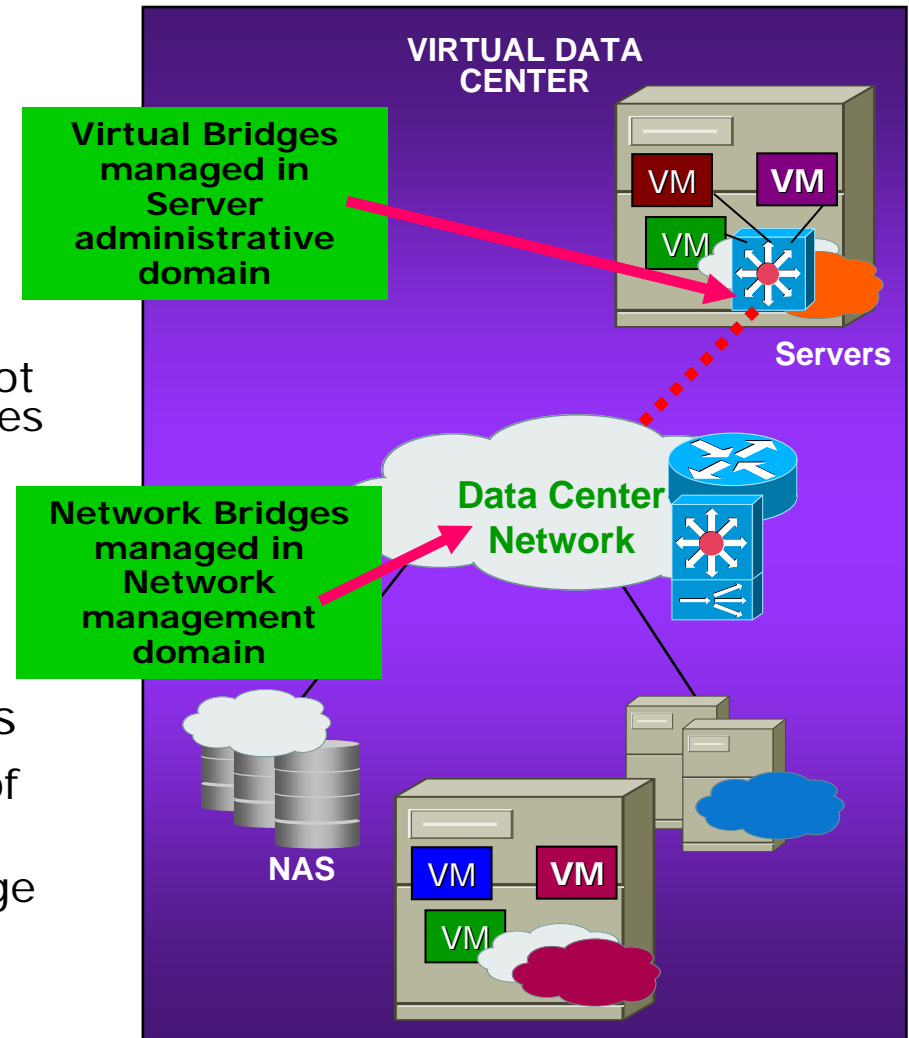


Virtual Bridging in Network Access Bridge

- Virtual Bridging migrates to Network Bridge
 - Network bridge aware of Virtualized Servers
- Network Access Bridge functionality
 - Both VM to VM, and VM to network communication handled by Network Bridge
- NIC virtualized and VFs directly assigned to VMs
 - NIC uplinks to be virtualized to multiple logical ports or “Virtual Ports”
- Virtualization of Network bridge ports connected to Servers
 - Server and NIC resources could have direct association with logical ports in the NIC and Bridge
- Virtual bridging in Access Bridge part Network management domain
 - Sharing of management information with Server Management
- Solutions should preserve Server virtualization capabilities such as VM migration

Virtual Bridge Management

- VMM (or IOVM) and NIC based Virtual Bridges managed by Server Administrators
- Network bridges managed by Network Administrators
 - Data Center Network policies may not be uniformly applied to Virtual bridges
- Need for uniform application of Network and Security policies
- Management information sharing between Network & Server domains
 - For example consistent application of policies incase of VM migration
 - Coexistence of different Virtual Bridge models



Considerations for Virtual Bridge Standardization ..(1)

- Multiple Virtual Bridging models expected to coexist in future
- No standardization may cause proliferation of Virtual Bridges with varying level of functionality
 - Likely to cause interoperability and management problems
 - Loss of bridge transparency for functions such as VM migration
 - Potential compatibility issues with existing and future IEEE 801.1 bridging standards
- Standardization of minimum functionality for Virtual bridges
 - Provides consistent definition of Virtual Bridging functionality
 - Ensures interoperability with multi-vendor solutions
- Compatibility with existing and future IEEE 802.1 bridging standards
 - Security functions such as port based access control (802.1X)
 - Interoperability with emerging Data Center Bridging standards
 - Consistent MIBs
 - Sharing of management information between two administrative domains (Server management and Network Management)



Considerations for Virtual bridging in Network Standardization ..(2)

- Standardization of solutions for Virtual Bridging in Networks Access Bridges
 - To ensure interoperability between Server and Network equipments
 - Standard mechanism for virtualization of Server Ethernet ports and Network Bridge ports
 - Protocol for transmission of Ethernet frames between Servers and Bridges
 - Protocol for configuration and management
- Compatibility with existing and future IEEE 802.1 bridging standards
 - Coexistence of Server based and Network based Virtual Bridge models
- Backward compatibility with existing Virtualized Server functionality
 - Compatibility with Virtual Server functionality such as VM Migration
 - Sharing of management information between two administrative domains (Server management and Network Management)



Summary

Virtual Bridge evolution

- Server based, and Network based Virtual bridging models evolving and expected to coexist
- Not having standardized functionality would create potential interoperability in the ecosystem

Standardization considerations

- Standardization in IEEE 802.1 will ensure compatibility with existing and emerging 802.1 bridging standards
- Compatibility to Server virtualization functions such as VM migration across Virtual Bridge models
- Consider standardization of Server based, and Network based Virtual bridging models in IEEE 802.1

